VIBRATION MOTOR BOOT

FIELD OF THE INVENTION

[0001] The present invention relates generally to mobile communication devices. More particularly, the present invention relates to a vibration motor boot for a mobile communication device.

BACKGROUND OF THE INVENTION

[0002] In recent years, mobile communication devices have become a popular communication tool. For example, providing businesspeople the capability to transmit and receive messages when they are not in the office has been very advantageous in allowing them to communicate with others on a more immediate basis. Moreover, such devices are also often used as organizers, a notebooks, and even an address books.

[0003] Some mobile communication devices play a tune in order to indicate to a user that a new message has been received. However, when a user is in a meeting or in a quiet location where silence is requested or required, an indicator lamp, located on the mobile communication device, may be turned on to indicate a new message has been received. Other than new messages, alerts for situations such as a phone call, an appointment reminder or a task reminder may be required.

[0004] Another method of alerting the user in these situations where silence is requested or required is via a vibration motor. When a new message is received, a vibration motor located within the mobile communication device causes the device to vibrate in order to alert to the user that a new message has been received.

[0005] In known mobile communication devices, the vibration motor is housed within a frame or a housing of the mobile communication device. In order to prevent the metal of the vibration motor from directly contacting the frame or housing, the vibration motor is placed into a vibration motor boot prior to being installed in the frame.

[0006] However, there are disadvantages with the tooling required to manufacture the location where the vibration motor boot and vibration motor rest within the frame or housing for known devices. In general, the frame or housing is manufactured using a mould comprising a core and cavity. In one known tooling method, the core is comprised of two

separate pieces which fit within the cavity. The presence of two separate core pieces causes more time to be spent on removing the core and the cavity from the finished frame or housing. In another known method, the injection mould comprises a single piece core and a single piece cavity. However, due to the angle of known vibration boots, there exists a gap at a bottom edge of the location within which the vibration motor boot rests. Since the vibration motor boot is manufactured from a flexible material such as silicone rubber, during installation, the boot is generally compressed within the gap which affects operation of the vibration motor. Furthermore, there is no support for the vibration motor and the vibration motor boot once it has been installed.

SUMMARY OF THE INVENTION

[0007] According to a first aspect of the present invention a boot for a vibration motor of a mobile communication device is provided. The motor has a generally flat upper surface and is adapted to be installed in a mounting slot in a mobile electronic device frame with said generally flat upper surface substantially parallel to an adjacent surface of said frame, and the mounting slot is angled from a normal of said adjacent surface. The boot comprises an outer surface corresponding to the shape and angle of said mounting slot, an exposed surface generally parallel to said adjacent surface, and a motor-receiving slot for receiving said vibration motor, said motor-receiving slot having an axis angled from an axis of said mounting slot and substantially normal with respect to said adjacent surface.

[0008] In accordance with another aspect of the present invention, there is provided a frame and vibration motor mounting assembly for a mobile communication device, comprising a frame disposed generally parallel to a reference plane, a mounting slot in a motor installation surface of said frame, said motor installation surface being angled away from said reference plane, said mounting slot being normal to said reference plane and accordingly angled with respect to said motor installation surface, and a boot positionable in said mounting slot, having an exposed surface generally parallel to said motor installation surface, and having a motor-receiving slot for receiving a vibration motor, said motor receiving slot having an axis angled from an axis of said mounting slot and generally normal with respect to said motor installation surface, whereby said vibration motor is configured to

be installed in said motor-receiving slot with an upper surface thereof generally parallel to said motor installation surface.

[0009] Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Embodiments of the present invention will now be described, by way of example only, with reference to the attached Figures, wherein:

Fig. 1 is a schematic diagram of a mobile communication device.

Fig. 2a is a schematic diagram of a vibration motor boot.

Fig. 2b is a schematic diagram of the front of the vibration motor boot.

Fig. 2c is a schematic diagram of the vibration motor boot housing a vibration motor.

Fig. 3a is a schematic diagram of a mobile communication device frame.

Fig. 3b is a schematic diagram of a mobile communication device frame with a vibration motor boot and vibration motor installed.

Fig. 4a is a schematic diagram of prior art tooling for manufacturing a mobile communication device frame.

Fig. 4b is a schematic diagram of prior art tooling for manufacturing a mobile communication device frame.

Fig. 4c is a schematic diagram of tooling for manufacturing a mobile electronic device frame for use with a vibration motor boot in accordance with an aspect of the present invention.

DETAILED DESCRIPTION

[0011] In Figure 1, a mobile communication device is shown. The mobile communication device **10** comprises a display **12**, a keypad **14**, a power button **16**, a cancel button **18** and a communication port **20**. The functionality of these parts will be well known to one skilled in the art. The electronic device **10** further comprises an indicator lamp **22** which preferably turns on when a new message is received by the device **10**. In this manner, the

user may be silently notified of new messages if the user is in a meeting or the like where silence is requested or required. However, if the mobile communication device **10** is not visible to the user, then the user might not realize that a new message has been received. Alternatively, the user may be notified of new messages by a vibration of the mobile communication device **10**. This is generally achieved via an internal vibration motor (not shown). The vibration motor is typically housed in a vibration motor boot which is preferably manufactured out of a flexible material such as silicone rubber to prevent the metal of the vibration motor from directly contacting the mobile communication device frame or housing when in use. Furthermore, if the vibration boot is not present, direct contact between the vibration motor and the frame during vibration may be noisy, which detracts from the provision of a quiet alert.

[0012] Figures 2a and 2b provide an isometric view and a front view of a vibration motor boot, respectively, while Figure 2c is an isometric view of the vibration motor boot housing a vibration motor.

[0013] The vibration motor boot **30** comprises a first surface **32** defining an outer surface of the boot **30**, having a top wall **34** connected at one end to a first end of a side wall **36** and at a second end to a first end of a second side wall **38**. In this embodiment, the side walls are connected at their second ends to a bottom wall **40** but may also be connected together forming a V-shaped bottom for the outer surface of the boot **30**. An angle α between the top wall **34** and the side wall **38** is preferably less than 90°.

[0014] The vibration motor boot **30** also comprises a second surface **42** defining an opening which receives a vibration motor **44** (as shown in Figure 2c). This second surface **42** may be seen as a motor receiving slot. In the present embodiment, the second surface **42** is offset axially at an angle **46** from the side wall **38** of the first surface **32**. The angle **46** may be between 5° and 60° in order to both provide support to the vibration motor and to simplify the tooling process for the manufacture of the mobile communication device frame or housing within which the vibration motor **44** and vibration motor boot **30** nest.

[0015] A length **L** of the vibration motor boot is selected so that most of the vibration motor **44** rests within the opening defined by the second surface **42** while a width **W** of the opening is selected so that there is a snug fit between the vibration motor **44** and the second

surface **42**. Preferably, the only part of the vibration motor **44** which rests outside of the boot **30** is a weight **47** which, when rotated about the motor axis, generates a vibration.

[0016] As shown in Figures 2b and 2c, the top wall **34** provides a location whereby contacts **50** of the vibration motor **44** rest. The contacts **50** are located at a normal direction to the vibration motor **44**. The position of the top wall **34** is designed to be located perpendicular to the normal of the vibration motor **44** after the vibration motor has been inserted into the opening. The top wall **34** also assists in retaining the vibration motor **44** when the motor is inserted into the vibration motor boot **30**.

[0017] The vibration motor boot **30** further comprises a rib **54** which assists in supporting a battery within the mobile communication device as will be described below with respect to Figure 3b. The end of the boot **30** near the rib **54** includes a circular opening **48** to receive the end of the vibration motor opposite the weight **47**.

[0018] A schematic diagram of a mobile communication device frame is shown in Figure 3a. The mobile communication device frame **56** comprises a battery location **58** along with a mounting slot **60**, seen as a nest, for receiving the vibration motor boot **30** and the vibration motor **44**. The shape of the mounting slot **60** preferably complements the side walls **36** and **38** and the bottom wall **40** of the first surface of the vibration motor boot **30**. In this embodiment, the mounting slot **60** comprises a bottom wall **62** along with two side walls **64** and **66**. In the present embodiment, part of the bottom wall **62** of the mounting slot **60** is open for housing the weight **47** in order to allow the vibration motor and the weight **47** to vibrate without directly contacting the frame, while fully supporting the vibration motor **44** on the bottom wall **62**. The solid part of the bottom wall **62** provides support to the vibration motor boot **30** and the vibration motor **44** when the two are nested into the frame as shown in Figure 3b. As described above, the vibration motor boot **30** is sized to match the mounting slot **60** in order for the vibration motor boot **30** to nest snugly within the mounting slot **60**.

[0019] As further shown in Figure 3b, when the vibration motor boot **30** and the vibration motor **44** are nested into the mounting slot **60**, the rib **54** protrudes into the battery location **58** to provide support for the battery, when the battery is installed. Battery contacts **68** are also located within the battery location **58** in order to provide power from the battery to the mobile communication device. The rib **54** biases the battery in the battery location **58** and works with the battery contacts **6°** to position the battery and prevent the battery from

rattling in the mobile communication device during a period when the motor is generating a vibration.

[0020] Turning to Figures 4a and 4b, schematic diagrams representing tooling for manufacturing known mobile communication device frames are shown. As can be seen at the top of Figure 4a, a core is comprised of two separate pieces which fit within a cavity. The presence of two separate core pieces causes more time to be spent on removing the core and the cavity, as indicated by the arrows, from the finished frame or housing. This also adds cost and complexity to the required tooling. As shown in Figure 4b, the tooling comprises a single piece core and a single piece cavity. However, due to the angle of prior art vibration boots, there exists a gap at the bottom edge of the location within which the vibration motor boot rests. Since the vibration motor boot is manufactured from a flexible material such as silicone rubber, during installation, the boot may be compressed within the gap which affects operation of the vibration motor. Furthermore, as can been seen in Figures 4a and 4b, the bottom wall of the mounting slot of each of the prior art frames is angled with respect to the base of the frame.

[0021] As shown in Figure 4c, the tooling **70** for manufacturing the mounting slot **60**, or nest, in the mobile communication device frame **56** or housing is shown. The tooling **70** comprises a single piece core **72** along with a single piece cavity **74**. Manufacturing a vibration motor boot **30** whereby the top wall of the first surface forms a perpendicular surface to the normal of the vibration motor **44**, as shown in Figures 2a, 2b and 2c), allows for tooling **70** to be created which provides a solid portion in the bottom wall **48** of the mounting slot **60** to support the vibration motor boot **30** after it has been nested into the frame **56**. The one-piece core **72** and one-piece cavity **74** also provides other advantages to the manufacturing process of the mobile communication device since less time is required to remove the tooling **70** once the frame **56** has been moulded either via an injection mould or other known manufacturing processes which reduces overall manufacturing time. After their manufacture, the one-piece core **72** and one-piece cavity **74** separate from the mobile communication device fame **56** in a direction as shown by arrows **76**.

[0022] By causing the top wall of the first surface of the boot **30** to form a perpendicular surface to the normal of the vibration motor **44** (as previously discussed above), the side walls **64** and **66** of the mounting slot **60** are substantially parallel to the

direction of the arrows **76** unlike the mounting slots of the prior art which are angled with respect to the direction of the arrows. This allows for the tooling to be more easily separated from the mobile communication device frame. Furthermore, there is also more support at the bottom of the mounting slot for the vibration motor boot and the vibration motor with respect to some mobile communication device frames such as the mobile communication device frame provided by the tooling shown in Figure 4b.

[0023] It will be understood that the vibration motor may be used to alert the user of scheduled tasks, a phone call, appointments, or other events, along with or instead of new messages.

[0024] Furthermore, it will be understood that although the invention has been described with reference to a mobile communication device, the vibration motor boot may also be implemented in a cell phone or other type of electronic device.

[0025] The above-described embodiments of the present invention are intended to be examples only. Alterations, modifications and variations may be effected to the particular embodiments by those of skill in the art without departing from the scope of the invention, which is defined solely by the claims appended hereto.